CHAPTER 5 MEASUREMENT

SUPPLEMENTARY INFORMATION ON THE MULTI-ADAPTOR MA-40A

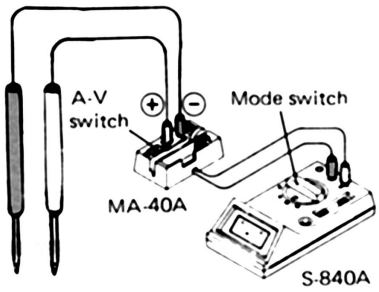
It is possible to measure voltage and resistance even with the Digital Multi-Tester S-840A and the Multi-Adaptor MA-40A in combination, if they are connected as shown in the illustration below.

To measure voltage and resistance,

1) set MA-40A's A-V switch to Ⓐ, and

2) set S-840A's mode as follows:

Voltage	:	DC V
Resistance	:	Ω



Note:

1. Voltage or resistance measurements on the following pages are described by connection diagrams using S-840A only. These measurements, however, can be made with S-840A and MA-40A in combination as explained in the above.

Voltage measurement	:	pages 34, 61, 64, 95, 102, 103, 104
Resistance measurement	:	pages 21, 29, 101

2. The Current Supplier S-833 is used in the connection diagrams on pages 27 and 30. These measurements, however, can be made using MA-40A and the Relay Cable S-842.

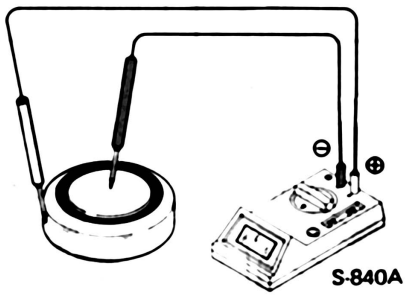
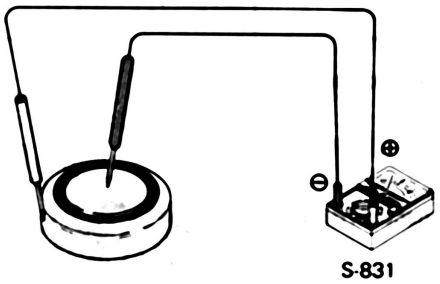
MEASURING METHOD

The measuring method differs, depending on the measuring instrument used. It is therefore explained for both the Digital Multi-Tester (S-840A) and the Volt-Ohm-Meter (S-831).

For the standard values of current consumption, coil resistance, etc., refer to the "PARTS CATALOGUE/TECHNICAL GUIDE" by caliber or the ANALOGUE QUARTZ or DIGITAL QUARTZ "VALUE CHECKING LIST".

1. MEASURING BATTERY VOLTAGE

Note: Use finger cots or bamboo or plastic tweezers to handle battery.

Instrument	S-840A	S-831
Setting	Apply the red and black probes to the battery. • Red probe . . . . . Battery (+) surface • Black probe . . . . . Battery (−) surface	
(Mode to be used)	DC V	DC 3V
Connection diagram	 S-840A	 S-831

■ CHECKING STANDARD OF BATTERY VOLTAGE

The nominal voltage of silver oxide batteries is 1.55V, and that of lithium batteries 3.0V. The checking standard of battery voltage is established independently of their nominal voltages to reflect instrumental errors in measurement. This will avoid judging the normal as defective.

The silver oxide battery remains stable in voltage up until it has been almost exhausted. Use a high-precision measuring instrument (such as S-840A) to measure its battery voltage, and fine voltage variations at the end of its life can be detected.

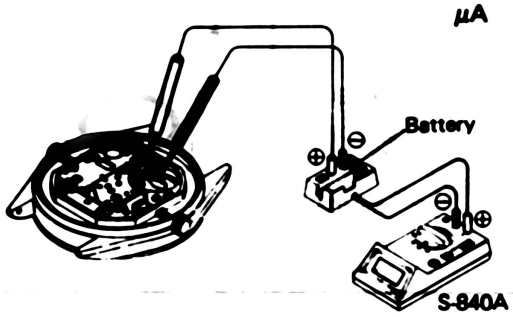
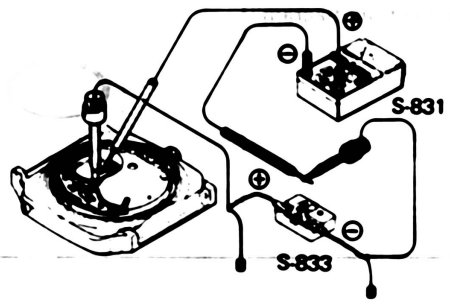
Instrument / Type of battery		S-840A	S-831
Silver oxide battery		More than 1.57V	More than 1.5V
Lithium battery	CR	More than 2.9V	More than 2.9V
	BR	More than 2.8V	More than 2.8V

2. MEASURING CURRENT CONSUMPTION FOR THE WHOLE OF THE MOVEMENT/MODULE

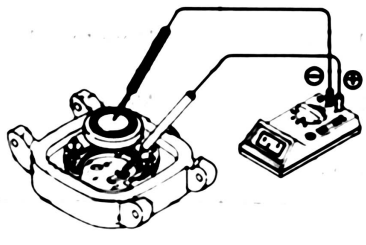
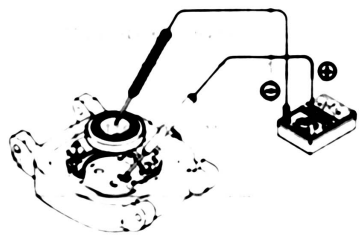
Note: There may be cases when S-831 swings its pointer beyond the maximum value on the dial when measuring current consumption with its mode at DC 12μA. In such a case, increase the range while keeping the probes applied as designated, until the pointer no longer overswings and, after 2 to 3 seconds, return the range to DC 12μA to measure current consumption again.

This is because there may be a large current flow somewhere in the circuit by the time the crystal oscillator begins to oscillate after the power is turned on. If the pointer still overswings, there must be a short circuit somewhere. Recheck the watch for a short, and measure current consumption for the whole of the movement/module after repairing the short.

2-a. By using a current supplier

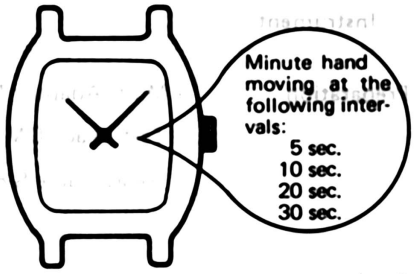
Instrument	S-840A	S-831
Preparation	• Multi-Adaptor MA-40A • Test Leads DM-10	• Current Supplier S-833
Setting	• S-840A's red probe: (+) conductive portion, such as battery connection (+), circuit block cover, etc. • S-840A's black probe: Battery connection (−)	• S-833's black IC clip: S-831's black probe • S-833's red IC clip: (+) conductive portion, such as battery connection (+), circuit block cover, etc. • S-831's red probe: Battery connection (−)
(Mode to be used) Connection diagram	μA 	DC 12μA 

2-b. By placing the battery on the (+) conductive portion

Instrument	S-840A	S-831
Setting	• Place the battery on the metal portion of the movement/module with its (+) surface down. • Apply the red probe to the battery connection (−). • Apply the black probe to the battery (−) surface.	
(Mode to be used) Connection diagram	μA 	DC 12μA 

REMARKS ON MEASURING FOR 2-HAND CALIBERS

For those 2-hand caliber watches with the minute hand moving at 5-second or greater intervals (5, 10, 20, and 30 seconds), measure their current consumption for the whole of the movement in the following sequence.

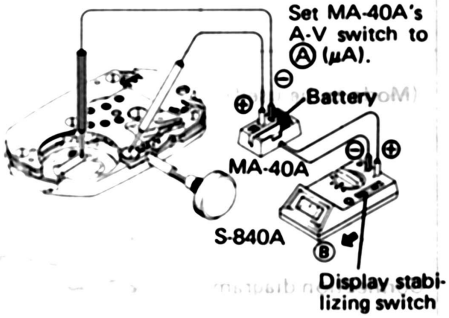


• By using S-840A

[Sequence] A 10-second step minute hand watch is taken as an example to describe the sequence.

1. Set the display stabilizing switch of the tester to the "B" position.
2. Apply the (+) and (−) probes of the tester as shown in the illustration on the right. The tester displays a value, indicating that electric current is flowing in the IC.
3. The value displayed is increased, since the driving current for the step motor flows once every 10 seconds.
4. After approximately one minute, read the maximum value which is displayed stably.

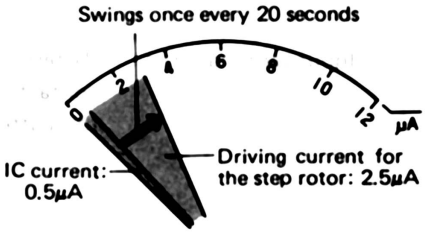
* The tester's value-averaging calculation function automatically takes an average of maximum and minimum current consumption values.



• By using S-831

[Sequence] A 20-second step minute hand watch is taken as an example to describe the sequence.

1. The meter's pointer swings once every 20 seconds when the meter's probes are applied as designated on the preceding page.
2. The meter's pointer slightly swings immediately after the probes are applied, indicating that electric current is flowing in the IC. After 20 seconds, it swings more, since the driving current for the step motor flows once every 20 seconds.
3. Calculate the current consumption as follows:



Ex.:

IC current = 0.5μA
IC current + Motor driving current = 3μA

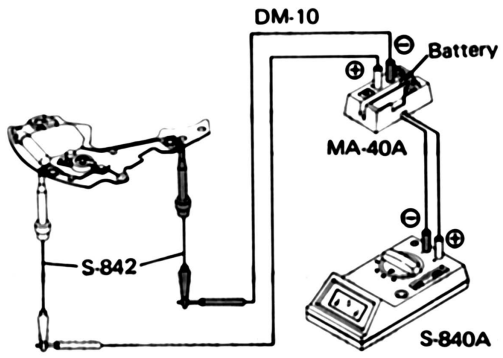
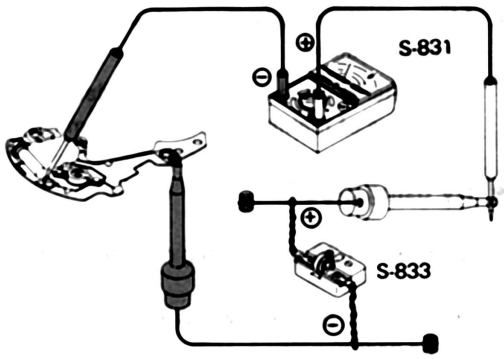
The current necessary for driving the motor alone is 2.5μA (3μA − 0.5μA). This value, however, shows the current consumption for the 20-second step. Therefore, it should be converted into the current consumption per second. Reduce the value 2.5μA to 1/20, and the current consumption necessary only for the step motor per second is 0.125μA.

Consequently, the current consumption value of this watch is:

0.5μA + 0.125μA = 0.625μA

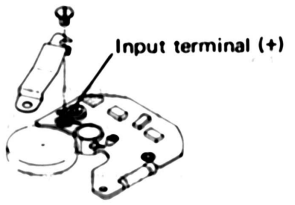
Note: In the case of those watches with the minute hand moving at 5-, 10-, or 30-second intervals, calculate their current consumption accordingly on the basis of the above example.

3. MEASURING CURRENT CONSUMPTION FOR THE CIRCUIT BLOCK ALONE

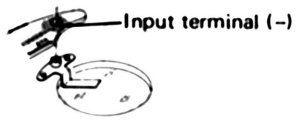
Instrument	S-840A	S-831
Preparation	• Multi-Adaptor MA-40A • Test Leads DM-10 • Relay Cable S-842	• Current Supplier S-833
Setting	• S-842's red IC clip: Input terminal (+) • S-842's black IC clip: Input terminal (-)	• S-833's red IC clip: S-831's red probe • S-833's black IC clip: Input terminal (-) • S-831's black probe: Circuit block's input terminal (+).
(Mode to be used) Connection diagram	μA 	DC 12μA 

■ HOW TO LOCATE THE CIRCUIT BLOCK'S INPUT TERMINALS (+) AND (-)

Input terminal (+) : Pattern portion of the circuit block to contact the battery connection (+) or the battery clamp.



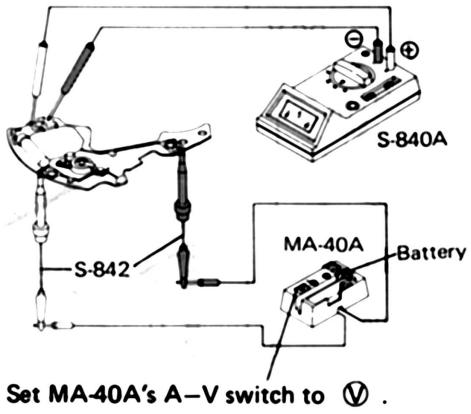
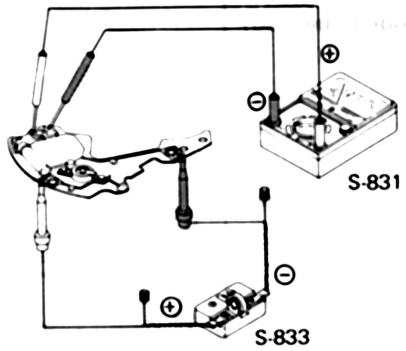
Input terminal (-) : Pattern portion of the circuit block to contact the battery connection (-).



- Refer to "STRUCTURE OF THE CIRCUIT BLOCK" in each caliber's "PARTS CATALOGUE/TECHNICAL GUIDE".

4. MEASURING OUTPUT SIGNAL OF THE CIRCUIT BLOCK

4-a. Measuring analogue output signal of the circuit block

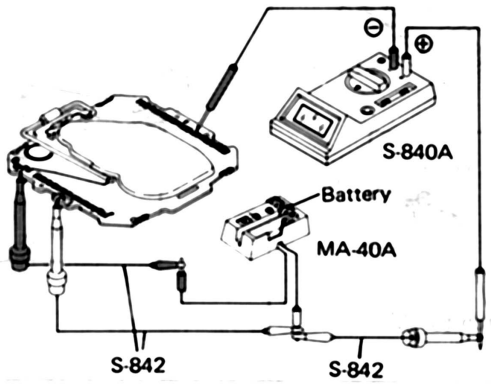
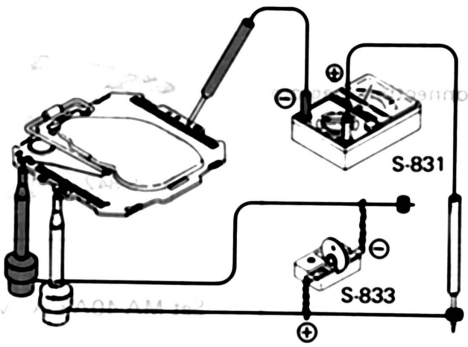
Instrument	S-840A	S-831
Preparation	• Multi-Adaptor MA-40A • Relay Cable S-842	• Current Supplier S-833
Setting	• S-842's red IC clip: Input terminal (+) • S-842's black IC clip: Input terminal (-) • S-840A's red and black probes: Circuit block's output terminals (regardless of polarity)	• S-833's red IC clip: Input terminal (+) • S-833's black IC clip: Input terminal (-) • S-831's red and black probes: Circuit block's output terminals (regardless of polarity)
(Mode to be used)	DC V	DC 3V
Connection diagram	 Set MA-40A's A–V switch to Ⓥ .	

• For information on how to locate the circuit block's input terminals (+) and (-), refer to page 98.

■ **How to locate the circuit block's output terminal:**

The circuit block's output terminal is located at the pattern portion to contact the coil block's pattern portion.

4-b. Measuring digital output signal of the circuit block

Instrument	S-840A	S-831
Preparation	• Multi-Adaptor MA-40A • Relay Cable S-842 (Black 1 pc./Red 2 pcs.)	• Current Supplier S-833
Setting	• S-842's red IC clip: Input terminal (+) • S-842's black IC clip: Input terminal (−) • S-842's red IC clip: S-840A's red probe • S-840A's black probe: Circuit block's output terminal	• S-833's red IC clip: Input terminal (+) • S-833's black IC clip: Input terminal (−) • S-831's red probe: S-833's (+) coil spring • S-831's black probe: Circuit block's output terminal
(Mode to be used)	DC V	DC 3V
Connection diagram		

- For information on how to locate the circuit block's input terminals (+) and (−), refer to page 98.

■ **How to see the circuit block's output terminal:**

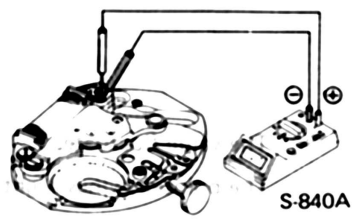
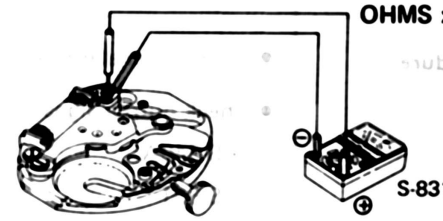
For the mutual connection between the circuit block and the segment, refer to "RELATIONSHIP BETWEEN THE SEGMENT (LIQUID CRYSTAL PANEL ELECTRODE) AND THE C-MOS-LSI OUTPUT TERMINAL" in each caliber's "PARTS CATALOGUE/TECHNICAL GUIDE".

5. MEASURING RESISTANCE OF THE COIL

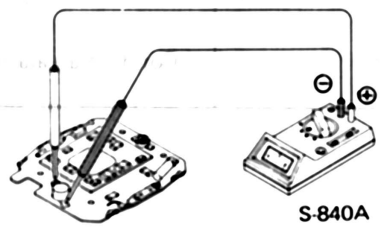
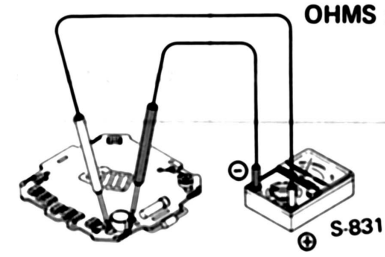
5-a. Coil block

Note:

- Measure resistance of the coil block with the coil block set in the main plate.
- Be careful not to break the coil wire with the instrument's probes.
- When using S-831, be sure to make a zero-ohm-adjustment before measuring.

Instrument	S-840A	S-831
Setting	• Apply the red and black probes to the coil block's pattern portions regardless of polarity.	
(Mode to be used)	Ω	OHMS x 100
Connection diagram		

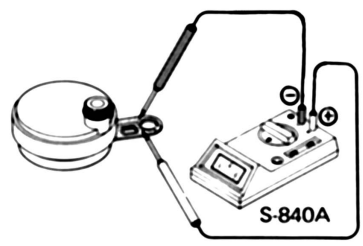
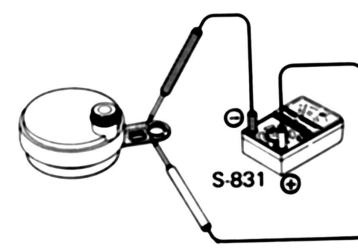
5-b. Upconverter coil

Instrument	S-840A	S-831
Setting	• Apply the red and black probes to the soldered portions at both ends of the upconverter coil regardless of polarity.	
(Mode to be used)	Ω	OHMS x 1
Connection diagram		

5-c. Speaker block

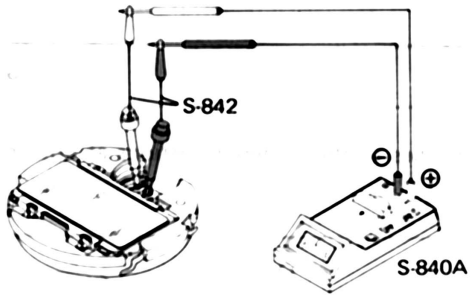
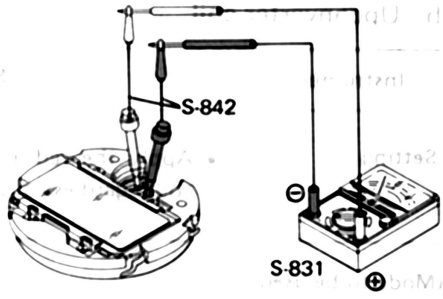
Note:

- Use antimagnetic tweezers to handle the speaker block.
- Be careful not to break the coil wire with the instrument's probes.

Instrument	S-840A	S-831
Setting	• Apply the red and black probes to the speaker block's lead terminal regardless of polarity.	
(Mode to be used)	Ω	OHMS x 1
Connection diagram		

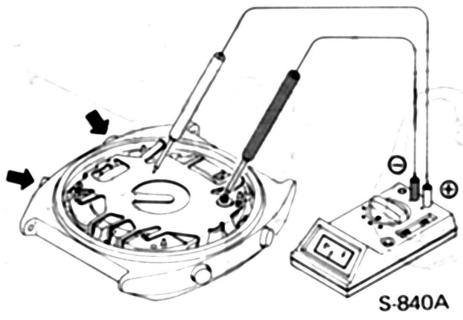
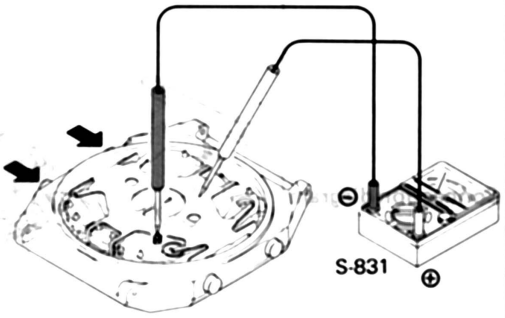
6. MEASURING ALARM OUTPUT SIGNAL

6-a. Speaker block type

Instrument	S-840A	S-831
Preparation	· Relay Cable S-842	
Setting	· S-842's red IC clip: Alarm output terminal 1 · S-842's black IC clip: Alarm output terminal 2 (Regardless of polarity)	
Procedure	● Conduct an alarm test operation. ● Check output signal. · S-840A: The value fluctuates. · S-831 : The pointer swings slightly	
(Mode to be used)	DC V	DC 3V
Connection diagram	 Conduct an alarm test operation.	 Conduct an alarm test operation.

6-b. Piezoelectric buzzer type

Note: Never use IC clips or alligator clips to hold a coil type buzzer lead terminal, since they may deform the buzzer lead terminal and consequently cause defective conductivity.

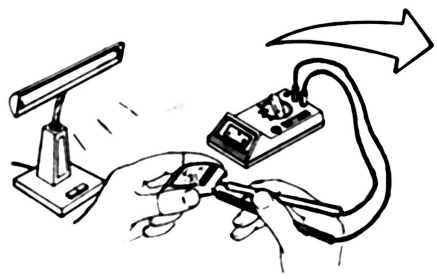
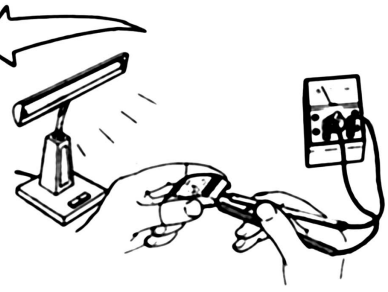
Instrument	S-840A	S-831
Setting	● Apply the red and black probes as shown in the diagram below. • Red probe: (+) conductive portion, such as battery clamp and battery clamp screw • Black probe: Buzzer lead terminal	
Procedure	● Conduct an alarm test operation. ● Check output signal. • S-840A : The value fluctuates. • S-831 : The pointer swings slightly.	
(Mode to be used)	DC V	DC 3V
Connection diagram		

● For those watches that have no alarm test function, set the alarm and measure alarm output signal when the alarm is ringing.

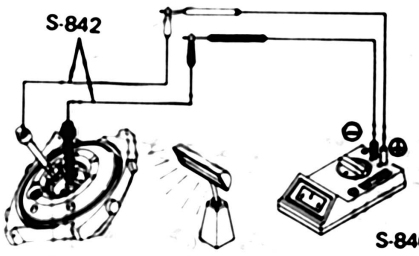
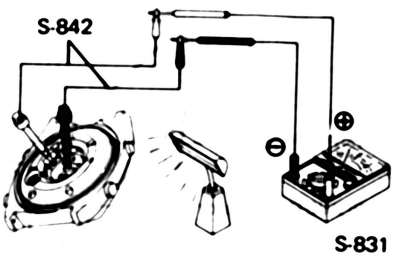
7. MEASURING OUTPUT OF THE SOLAR CELL

Note: Measure output of the solar cell, keeping the solar cell exposed to a light source. In advance, wipe off dust on the solar cell panel. Also be careful not to obstruct light with hands, etc.

7-a. Measuring output of the solar cell

<table>
<tr><th>Instrument</th><th>S-840A</th><th>S-831</th></tr>
<tr><td>Setting</td><td colspan="2">• Apply the red and black probes to the solar cell's lead terminals.
(In the case of solar cell with one lead terminal
• Red probe: Metal portion of the case
• Black probe: Solar cell's lead terminal)</td></tr>
<tr><td>Procedure</td><td colspan="2">• Measure output, exposing the solar cell panel to a light source.
Light source: at a distance of 20 ~ 40 cm from a white fluorescent lamp (10 ~ 30W)</td></tr>
<tr><td>(Mode to be used)</td><td>DC V</td><td>DC 3V</td></tr>
<tr><td>Connection diagram</td><td>  </td><td>  </td></tr>
<tr><td></td><td>The probes may be applied regardless of polarity, but the tester displays values with (+) or (−) before digits.</td><td>If the meter's pointer swings in opposite direction, reverse the probes in applying them.</td></tr>
</table>

7-b. Measuring output between the solar cell and the secondary battery

Instrument	S-840A	S-831
Preparation	· Relay Cable S-842	
Setting	· S-842's red IC clip: (+) conductive portion, such as battery clamp and battery clamp screw · S-842's black IC clip: Battery connection (-)	
Procedure	● Measure output, exposing the solar cell panel to a light source. Light source: at a distance of 20 ~ 40 cm from a white fluorescent lamp (10 ~ 30W)	
(Mode to be used)	μA	DC 12μA
Connection diagram		

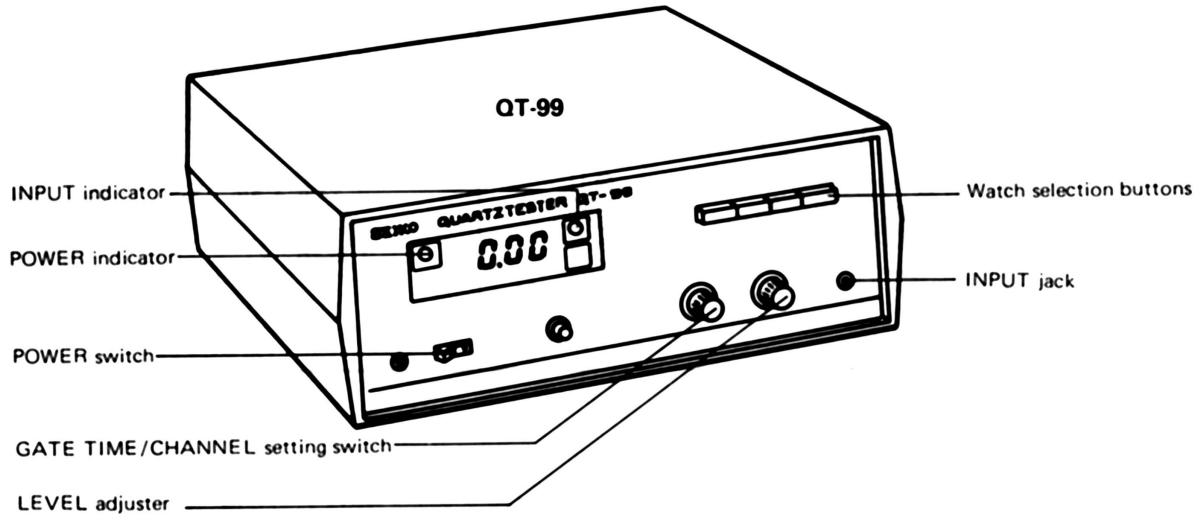
8. MEASURING ACCURACY

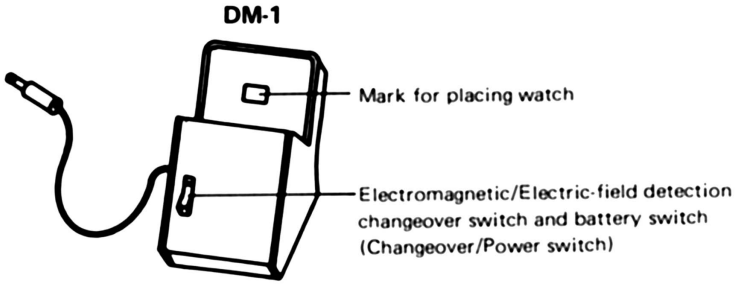
An explanation is given below on how to measure accuracy, using the Quartz Tester QT-99 and the Electromagnetic/Electric-field Detection Microphone DM-1.

Note:

- Immediately after the watch is taken off the wrist, the daily rate keeps fluctuating. Wait, therefore, for 5 to 10 minutes and then measure accuracy. This is because the watch is affected by a difference in temperature between the wrist and the measuring spot, and it is not a malfunction.
- Electric noises, such as those emanated by fluorescent lamps and motors, may hinder the daily rate from being correctly measured. Do not bring fluorescent lamps and other electric noise sources close to the microphone at the time of measuring.
- For information on how to measure accuracy of those watches whose time loss/gain is expressed as an annual rate, refer to the "PARTS CATALOGUE/TECHNICAL GUIDE" by caliber.

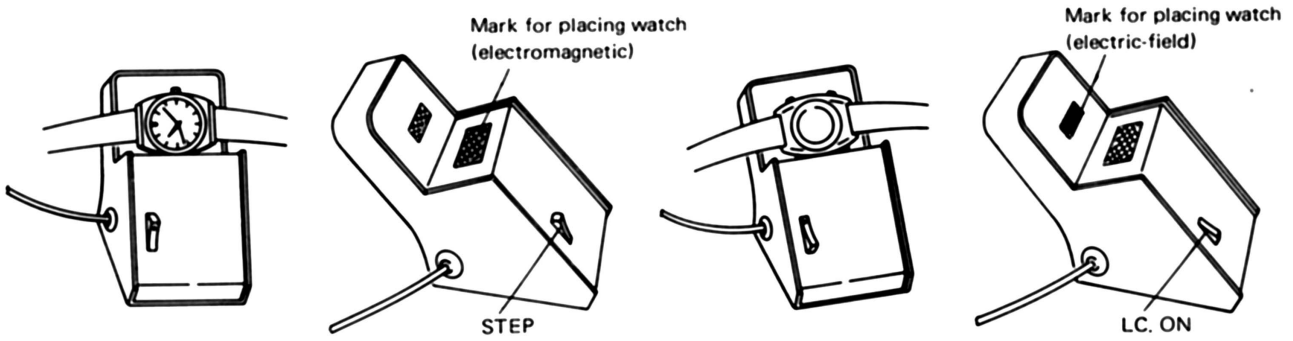
(1) Main parts of QT-99 and DM-1





(2) Accuracy measuring (output signal checking) procedure

	Analogue Quartz	Digital Quartz
1	Turn the power switch on.	Turn the power switch on.
2	Connect the microphone to the tester's input jack, and set the microphone's changeover/power switch to "STEP".	Connect the microphone to the tester's input jack, and set the microphone's changeover/power switch to "LC. ON".
3	Push in the watch selection STEP button of the tester.	Push in the watch selection LCD button of the tester.
4	Place the watch on the microphone's mark for placing watch with the crown up.	Place the watch on the microphone's mark for placing watch with the liquid crystal panel facing the mark.
5	Select the measuring gate corresponding to the hand motion.	Check that the INPUT indicator is lit up.
6	Read the daily rate on the tester's display panel. Check output signal by seeing if the INPUT indicator is flashing.	Read the daily rate on the tester's display panel.



Note:

- For selection of the measuring gate, refer to the "PARTS CATALOGUE/TECHNICAL GUIDE" by caliber or ANALOGUE QUARTZ or DIGITAL QUARTZ "VALUE CHECKING LIST".
- In the case of digital quartz watches, the display to be selected for measuring differs, depending on calibers. For details, refer to the "PARTS CATALOGUE/TECHNICAL GUIDE" by caliber or ANALOGUE QUARTZ or DIGITAL QUARTZ "VALUE CHECKING LIST".
  The LEVEL adjuster may usually be kept at the "AUTO" position. If the INPUT indicator flashes irregularly or does not light up, turn the LEVEL adjuster to keep the INPUT lamp lit.